WHAT IS CLAIMED IS:

1. A modified hydrotreating catalyst comprising a support formed of refractory oxides, at least one metal from Group VIII and at least one metal from Group VI, both in the oxidized form, characterized in that it comprises at least one sulfone compound and/or sulfoxide compound derived from at least one benzothiophene compound.

2. The catalyst as claimed in claim 1, characterized in that said compound is chosen from sulfones and sulfoxides of benzothiophenes, of dibenzothiophenes and more generally of polyarylthiophenes, which may or may not be substituted by alkyl or allyl hydrocarbon chains optionally comprising aliphatic and/or aromatic rings, this compound being used alone or as a mixture with other compounds of the same group.

3. The catalyst as claimed in either of claims 1 and 2, characterized in that said compound is a commercial sulfone and/or sulfoxide compound or a sulfone and/or sulfoxide compound originating from the oxidation of the benzothiophene compounds present in the hydrocarbon fractions obtained by refining crude oils.

4. The catalyst as claimed in one of claims 1 to 3, characterized in that at least one of the sulfone and/or sulfoxide compounds results from the oxidation of a desulfurized or nondesulfurized hydrocarbon fraction by an oxidizing compound chosen from organic and inorganic peroxides and hydroperoxides and organic or inorganic peracids, optionally in the presence of a metal catalyst.

5. The catalyst as claimed in one of claims 1 to 4, characterized in that it comprises at least 0.01%

by weight of at least one sulfone and/or sulfoxide compound.

6. A process for the preparation of a catalyst as claimed in one of claims 1 to 5, comprising a stage of formation and/or of deposition of sulfone and/or sulfoxide compounds at the surface of a metal catalyst comprising a support formed of refractory oxides and at least one metal from each of Groups VI and VIII in the oxidized form.

7. The process as claimed in claim 6, characterized in that an organic fluid comprising at least one benzothiophene compound and an oxidizing compound from the group consisting of organic or inorganic peroxides and hydroperoxides and organic or inorganic peracids is introduced into a reactor comprising the metal catalyst, starting from ambient temperature and at atmospheric pressure, and the catalyst supporting the sulfoxide and/or sulfone compounds which are formed is subsequently recovered.

8. The process as claimed in claim 7, characterized in that the organic fluid is chosen from paraffin, aromatic and naphthenic hydrocarbons and the solvents for benzothiophene compounds and hydrocarbon fractions resulting from the refining of crude oils.

9. The process as claimed in either of claims 7 and 8, characterized in that the organic fluid is a hydrocarbon fraction with minimum and maximum boiling points ranging from 40 to 560°C.

10. The process as claimed in one of claims 6 to 9, characterized in that it consists in carrying out, in the presence of the metal catalyst, an oxidizing desulfurization of a hydrocarbon

fraction with minimum and maximum boiling points varying from 40 to 560°C.

11. The process as claimed in one of claims 6 to 10, characterized in that the catalyst comprises a support made of silica and/or of alumina and a combination of metals from Groups VI and VIII, in the oxidized form, chosen from the group consisting of nickel/molybdenum, cobalt/molybdenum, nickel/tungsten, nickel/cobalt/molybdenum and nickel/tungsten/molybdenum combinations.

12. The process as claimed in one of claims 6 to 11, characterized in that the metal catalyst is fresh or regenerated.

13. The process as claimed in one of claims 6 to 12, characterized in that the preparation of the hydrotreating catalyst is carried out in situ in the hydrotreating reactor or ex situ.

14. The use of the catalyst as claimed in one of claims 1 to 5 in a process for the hydrotreating of hydrocarbons after in situ or ex situ sulfurization of this catalyst by at least one sulfur compound chosen from hydrogen sulfide, mercaptans, sulfides and/or polysulfides and other sulfurizing compounds or by the feedstock to be hydrotreated.

15. A process for the purification, down to less than 10 ppm of sulfur, of a sulfur-comprising, nitrogen-comprising and/or aromatic hydrocarbon feedstock, comprising a first stage of hydrotreating the hydrocarbon feedstock in the presence of the catalyst as claimed in one of claims 1 to 5, after sulfurization of this catalyst, and a second stage of oxidizing desulfurization of the hydrotreated feedstock.

16. The process as claimed in claim 15, characterized in that the oxidizing desulfurization is carried out in the presence of a metal catalyst based on refractory oxides supporting at least one metal from each of Groups VI and VIII and of an oxidizing agent chosen from organic or inorganic peroxides and hydroperoxides and organic or inorganic peracids, hydrogen peroxide and tert-butyl hydroperoxide being preferred.

17. The process as claimed in claim 16, characterized in that the modified metal catalyst obtained at the end of the oxidizing desulfurization cycle is used as hydrotreating catalyst, after ex situ sulfurization or in situ sulfurization in the hydrotreating reactor.

18. The process as claimed in one of claims 15 to 17, characterized in that it is carried out in the same reactor or in at least two separate reactors.

19. The process as claimed in claim 18, characterized in that the two separate reactors operate alternately in hydrotreating and in oxidizing desulfurization, each carrying out a different treatment.

20. The process as claimed in claim 18, characterized in that one of the reactors always operates in hydrotreating and the other reactor always operates in oxidizing desulfurization.

21. The process as claimed in one of claims 15 to 20, characterized in that the hydrocarbon feedstock is a hydrocarbon feedstock with minimum and maximum boiling points of between 40 and 560°C.